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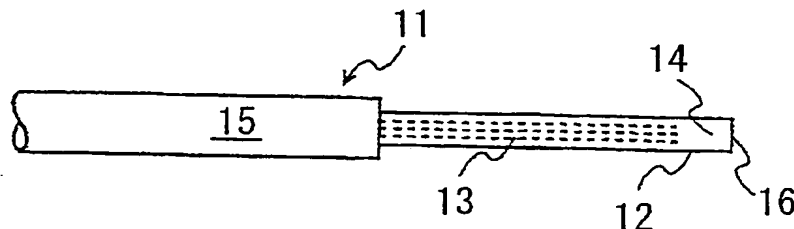
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[続葉有]

(54) Title: OPTICAL FIBER, OPTICAL FIBER CONNECTING METHOD, AND OPTICAL CONNECTOR

(54) 発明の名称: 光ファイバ、光ファイバの接続方法及び光コネクタ



(57) Abstract: An optical fiber which, at an optical fiber connecting end having a plurality of voids around the periphery of a core, has a light-permeable substance, such as a resin or glass whose refractive index is lower than that of quartz type substances, filled in the voids adjacent the connecting end. An optical fiber connecting section where an optical fiber having a plurality of voids in a clad around the periphery of a core is connected to another optical fiber, wherein the optical fiber is connected end-to-end to aforesaid another optical fiber through a refractive index matching agent whose refractive index at the minimum temperature in actual use is lower than that of the core.

(57) 要約: コアの周囲に複数の空孔を有する光ファイバの接続端部において、接続端部近傍の空孔に石英系材料より屈折率が低い樹脂またはガラス等の光透過性物質が充填されている光ファイバ。コアの周囲のクラッド内に複数の空孔を有する光ファイバを、他の光ファイバと接続した光ファイバの接続部において、上記光ファイバを、実使用上の最低温度における屈折率が上記コアより低い屈折率整合剤を介して上記他の光ファイバと突き合わせ接続した光ファイバの接続部。

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KG, KZ, MD, RU, TJ, TM), ヨーロッパ (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

添付公開書類:

— 国際調査報告書

(84) 指定国 (表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア (AM, AZ, BY,

2文字コード及び他の略語については、定期発行される各PCTガゼットの巻頭に掲載されている「コードと略語のガイダンスノート」を参照。

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/009619

## A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl<sup>7</sup> G02B6/00, G02B6/10, G02B6/255, G02B6/38

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl<sup>7</sup> G02B6/00, G02B6/10, G02B6/24-6/255, G02B6/38-6/40

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2004  
Kokai Jitsuyo Shinan Koho 1971-2004 Jitsuyo Shinan Toroku Koho 1996-2004

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                   | Relevant to claim No.                      |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| X<br>Y    | JP 2002-236234 A (Sumitomo Electric Industries, Ltd.),<br>23 August, 2002 (23.08.02),<br>Par. Nos. [0035] to [0037]; Fig. 6<br>& EP 1233290 A2<br>Par. Nos. [0035] to [0038]; Fig. 6<br>& US 2002-106164 A1                          | 1, 3, 4, 21-23<br>2, 5, 6, 16-20,<br>24-28 |
| Y         | WO 1999/685 A1 (THE SECRETARY OF STATE FOR DEFENCE),<br>07 January, 1999 (07.01.99),<br>Column 1, line 15 to column 11, line 23; Fig. 2<br>& GB 2341457 A & EP 991967 A<br>& US 6334019 B1 & US 2002-122644 A1<br>& JP 2002-506533 A | 2                                          |

☒ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

|                                                                                                                                                                         |                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| * Special categories of cited documents:                                                                                                                                | "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention                                              |
| "A" document defining the general state of the art which is not considered to be of particular relevance                                                                | "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone                                                                     |
| "E" earlier application or patent but published on or after the international filing date                                                                               | "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art |
| "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) | "&" document member of the same patent family                                                                                                                                                                                                    |
| "O" document referring to an oral disclosure, use, exhibition or other means                                                                                            |                                                                                                                                                                                                                                                  |
| "P" document published prior to the international filing date but later than the priority date claimed                                                                  |                                                                                                                                                                                                                                                  |

Date of the actual completion of the international search  
08 October, 2004 (08.10.04)

Date of mailing of the international search report  
26 October, 2004 (26.10.04)

Name and mailing address of the ISA/  
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2004/009619

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                 | Relevant to claim No. |
|-----------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Y         | JP 2002-243972 A (Mitsubishi Cable Industries, Ltd.),<br>28 August, 2002 (28.18.02),<br>Par. Nos. [0019], [0024] to [0025]; Fig. 4 | 5, 6                  |
| X         | JP 2003-167145 A (Fujikura Ltd.),<br>13 June, 2003 (13.06.03),<br>Par. Nos. [0039] to [0046]; Fig. 1<br>(Family: none)             | 7-15                  |
| Y         | JP 6-73359 A (Nippon Telegraph And Telephone Corp.),<br>15 March, 1994 (15.03.94),<br>Par. No. [0009]; table 1<br>(Family: none)   | 16-20, 24-28          |

**INTERNATIONAL SEARCH REPORT**

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**Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)**

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically: Claims 26-25
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

**Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)**

This International Searching Authority found multiple inventions in this international application, as follows:

(1) Inventions as claimed in Claims 1-20 are an invention which, at an optical fiber end having voids around the periphery of a core, seals voids in the vicinity of the end by using a light-permeable substance, such as a resin or glass whose refractive index is lower than that of quartz type substances.

On the other hand, inventions as claimed in Claims 21-28 are an invention relating to connecting an optical fiber having voids around the periphery of a core to another optical fiber.

Therefore, no technical relation in the meaning of PCT Rule 13 can (continued to extra sheet)

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

**Remark on Protest**

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/JP2004/009619

Continuation of Box No. III of continuation of first sheet (2)

be found between the inventions as claimed in Claims 1-20 and the inventions as claimed in Claims 21-28.

(2) The matter common to Claims 1-6, Claims 7-20 is the fact that at the end of an optical fiber having voids around the periphery of a core, the voids adjacent the end are sealed by a light-permeable substance, such as a resin or glass whose refractive index is lower than quartz type materials.

As a result of the search, however, it is obvious that the common matter is not novel as it is disclosed in JP 2002-236234A (Sumitomo Electric Industries, Ltd.), 23 August, 2002 (23.08.02), Paragraphs 0035-0037, Fig. 6.

As a result, since the common matter falls within the category of the prior art, this common matter is not a special technical feature in the meaning of the second sentence of PCT Rule 13. 2.

Further, other common matter considered as a special technical feature in the meaning of the second sentence of PCT Rule 13. 2 is not present. Therefore, no technical relation in the meaning of PCT Rule 13 can be found between Claims 1-6 and Claims 7-20.

(3) Accordingly, the inventions as claimed in Claims 1-6, the inventions as claimed in Claims 7-20, the inventions as claimed in Claims 21-28 do not comply with the requirement of unity of invention.